Advanced Analysis

1a. Given weather charts, analyze for upper-level features within two hours as determined by a master solution.

Isoplething Parameters

- ***Height***
  - Isopleths of height on a constant pressure chart are called contours.
  - Contours are drawn as solid black lines .
    - The interval varies from level to level.
    - Open contours are labeled at each end of the contour at a minimum.
    - Closed contours are labeled at the top center of the contour.

Isoplething Parameters

- Contours are labeled in decameters.
- Intermediate contours are drawn as dashed black lines.
  - They are drawn whenever standard contours do not provide sufficient detail.
  - They are drawn only over portions of the chart where they are needed.
  - Unlike standard contours, they may start and stop in the middle of the chart.

Isoplething Parameters

  - They are labeled the same as standard contours.
- Although contours are drawn to the height field, the completed contours also represent the wind field.
- When drawing contours, you MUST consider the winds. Contours closely parallel the winds.
  - Winds should not cross contours except in areas of super/subgradient flow.
  - The faster the winds in a region, the tighter the contour gradient necessary to support those winds.

Isoplething Parameters

- ***Temperature***
  - Isopleths of temperature are called isotherms.
  - Isotherms are drawn as dashed red lines.
    - They are drawn every 5C° from a base of O°C (requirements may vary in the field)
    - Open isotherms are labeled at each end of the isotherm at a minimum.
    - Closed isotherms are labeled at the top center of the isotherm.

Isoplething Parameters

- ***Wind Speed***
  - Isopleths of wind speed are called isotachs.
  - Isotachs are drawn as dashed green lines.
    - They are drawn every 20 knots from a base of 50 knots. The 10 and 30 knot isotachs are not depicted.
    - Open isotachs are labeled at each end of the isotach at a minimum.
    - Closed isotachs are labeled at the top center of the isotach.

Atmospheric Features

- ***Jet Stream***
  - The minimum wind speed criterion for a jet stream is 50 knots.
  - The jet stream axis is drawn as a solid red line with arrowheads placed at intervals along the line. The interval should be small enough so that the direction of flow can be easily determined.

Atmospheric Features

- Use the jet stream axis position on your vorticity and thickness charts to aid with your jet-stream analysis.
  - Channel jet segments are generally associated with the strongest wind speeds. Channel jet segments will not cross contours.
  - Advection jet segments are associated with wider, more diffuse areas of strong winds. Advection jets will cross contours at significant angles.

Atmospheric Features

- ***Jet Maxima***
  - A jet maxima is an area of concentrated strong winds.
  - Jet maxima are more or less football/banana shaped.
  - The isotach gradient should be greater toward the +n side of the jet stream.

Atmospheric Features

- The area inside the innermost (highest) isotach associated with the jet maximum is shaded purple and labeled “Jxxx” where “xxx” is the maximum wind speed. Example: J135
  - Maximum wind speed at least as strong as fastest reported wind and may be slightly higher.
  - If nearest wind report is a considerable distance from jet maximum, maximum speed should be slightly stronger than reported wind.
  - Round speed to nearest 5 knots.

Atmospheric Features

- ***High and Low Height Centers***
  - Known Centers
    - High and low height centers are “known” i f a closed circulation exists on chart.
    - The best way to determine if a closed circulation exists is to look for wind with an easterly component.
      - Easterly winds in a trough indicate a closed low center exists.
      - Easterly winds in a ridge indicate a closed high center exists.

Atmospheric Features

- Depiction
  - Highs are depicted with a large (approximately 1 inch high) blue “H”. The actual location of the center is depicted with an (x) inside a circle.
  - Lows are depicted with a large (approximately 1 inch high) red “L”. The actual location of the center is depicted with an (x) inside a circle.

Atmospheric Features

- Central Height
  - Central height is the height of the constant pressure surface at the center of a known high or low.
  - For highs, the central height must be at least as high as the nearest reported value. For lows, the central height must be at least as low as the nearest reported value.
  - If the high/low center is between stations use the wind to help estimate the central height. (Stronger winds indicate a stronger gradient and hence, stronger system.)

Atmospheric Features

- For example, if the lowest height reported near a low on the 500 mb chart is 532 dam but that station is reporting a wind of 0245 then estimate the central height as about 529 dam. If the wind was only 0210 then estimate the central height as about 531 dam.
- Write the central height of the center next to t he “L” or “H”.
  Use decameters rounded to the nearest decameter. Underline the number. (In the above example, the central height would be written “<u>531</u>”.)

Atmospheric Features

- Unknown Centers
  - Unknown centers are systems whose center is located off the edge of your chart.
  - Depiction
    - » Unknown highs are depicted with a large (approximately 1 inch high) blue "H" and labeled with an underlined "u" in place of the central height.
    - » Unknown lows are depicted with a large (ap proximately 1 inch high) red "L" and label ed with an underlined "u" in place of the central height.

Atmospheric Features

- The thickness and vorticity charts may be used to help determine whether the location of a system is known or unknown. If data is sparse in a region, use the vorticity chart's placement of the feature to assist in your analysis. Use the thickness chart to help determine its stack to intermediate levels.

Atmospheric Features

- ***Warm and Cold Pockets***
  - Warm and cold pockets are areas of warmer (colder) air encircled by colder (warmer) air.
  - Depiction
    - Warm Pockets - The area inside the innermost isotherm is shaded red and labeled with a red "W”
    - Cold Pockets - The area inside the innermost isotherm is shaded blue and labeled with a blue "K".

Atmospheric Features

- ***Short-wave Trough and Ridge Axes***
  - Depiction
    - Trough Axis - A solid black line
    - Ridge Axis - A sawtooth black line

Atmospheric Features

- Short-wave Trough Identification
  - Cyclonic turning of the contours or winds indicates the possible presence of a short-wave trough.
  - A thermal trough indicates the possible presence of a short-wave trough. The short-wave trough axis will be located downstream from the thermal trough axis.

Atmospheric Features

- A vorticity advection lobe which represents an axis of high absolute vorticity indicates the possible presence of a short-wave trough.
  - Vorticity is sensitive to subtle turning in the horizontal wind field. Investigate every advection lobe carefully for a possible short-wave trough.
  - A short-wave trough should not be analyzed based solely on the vorticity chart. Other indicators MUST confirm the existence of the trough.
- Moisture at upper levels is an indication of a possible short-wave trough.

Atmospheric Features

- Twelve hour height changes are excellent indicators of short-wave troughs.
  - The plotted numbers are height changes, NOT height tendencies.
  - Just because a height fall is being reported does not mean the heights are falling at the time of the observation.

Atmospheric Features

- Because height changes rather than height tendencies are plotted short-wave troughs will be located along strong gradients in the height change field with…
  - » Height falls ahead of the trough and height rises behind it.
  - » Larger height falls ahead of the trough and smaller height falls behind it.
  - » Smaller height rises ahead of the trough and larger height rises behind it.

Atmospheric Features

- Short-wave Ridge Identification
  - Anticyclonic turning of the contours or winds indicates the possible presence of a short-wave ridge.
  - A thermal ridge indicates the possible presence of a short-wave ridge. The short-wave ridge axis will be downstream from the thermal ridge axis.
  - Vorticity advection lobes which represent axis of low absolute vorticity should be investigated for possible short-wave ridges.

Atmospheric Features

- Short-wave ridges are located in areas of strong gradients in the height change fi eld with …
  - Height rises ahead of the ridge and height falls behind it.
  - Larger height rises ahead of the ridge and smaller height rises behind it.
  - Smaller height falls ahead of the ridge and larger height falls behind it.

Atmospheric Features

- Notes on Short Wave Identification
  - As a short-wave trough moves through a long-wave ridge, it will often become “masked” in the ridge.
  - When this occurs, the contours/winds will generally only show a slight flattening of the anticyclonic turning.
  - Vorticity advection lobes and thermal troughs are especially useful for locating short-wave troughs in this situation.

Atmospheric Features

- ***Moisture***
  - At upper levels we are concerned about the nearness of air to saturation since this best relates to the development of clouds and precipitation.
  - The moisture variable plotted on upper air charts is the dew-point depression ($T - T_d$). The smaller this number, the closer the air is to saturation.

Atmospheric Features

- Analysis Parameters
  - Areas with dew-point depressions less than or equal to 5C° are enclosed within a scalloped green line.
    - An area about 1/2 inch wide “ inside” this line is shaded green.
    - While these regions are near saturation, clouds may not be present.
  - Areas with dew-point depressions less than or equal to 2C° are encircled with another scalloped green line.
    - The entire area inside this line is shaded green.
    - These are regions where clouds are likely to be present.

Atmospheric Features

- An area with dew-point depressions less than or equal to 2C° MUST be surrounded by an area of dew point depressions less than or equal to 5C°.

Continuity

- ***Since your goal will be to forecast the evolution of weather patterns, it is important to accurately track the past movement of weather systems since this often provides a clue as to future development.***

Continuity

- ***Keeping continuity on systems means tracking the systems over time. In order to make this easier, past positions of significant weather features are drawn on weather charts as the first step of the analysis process.***
- ***In Block III, you will plot the position of weather features 12 hours earlier using a yellow highlighter.***

Continuity

- ***Continuity is kept on the following features:***
  - Jet-Stream Axis
  - Jet-Stream Maxima Position and Intensity
  - Low- and High-Height Center Position and Intensity
  - Short-wave Ridge and Trough Position

Chart Preparation

- **300 mb Chart Preparation**
  - ***Trace the past position of features on your chart (Continuity).***
  - ***Analyze height contours every 12 dam from a base of 912 dam.***
  - ***Locate and label high- and low-height centers.***
  - ***Analyze the wind field using isotachs.***
  - ***Locate and label the jet-stream axis on the chart.***
  - ***Locate and label jet maxima.***

Chart Preparation

- **500 mb Chart Preparation**
  - *Trace the past position of features on your chart (Continuity).*
  - *Analyze height contours every 6 dam using a base of 558 dam.*
  - *Locate and label high- and low-height centers.*
  - *Analyze the temperature field using isotherms.*
  - *Locate and label warm and cold pockets.*

Chart Preparation

- *Analyze areas of moisture.*
- *Locate and label short-wave trough and ridge axes.*

Chart Preparation

- **700 mb Chart Preparation,**
  - ***Trace the past position of features on your chart (Continuity).***
  - ***Analyze height contours every 3 dam from a base of 300 dam.***
  - ***Locate and label high- and low-height centers.***
  - ***Analyze the temperature field using isotherms.***
  - ***Locate and label warm and cold pockets.***

Chart Preparation

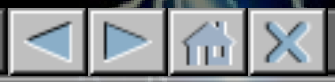
- *Analyze areas of moisture.*
- *Locate and label short-wave trough and ridge axes.*

General Chart Preparation Guidelines

- **Label the chart type, valid time, and write your rank and name in the lower left hand corner.**
- **Outline the United States and Mississippi in orange.**
- **Outline the Great Lakes in blue.**

Analysis Hints

- **Always use PENCIL to analyze your charts.**
  - ***Work from the top down. Start with the 300 mb chart then proceed to the 500 mb chart and finish up with the 700 mb chart.***
  - ***Analyze all the isopleths first and then go back through and locate features.***
  - ***Finally, compare your depiction of features at the different levels to ensure they stack properly.***



Analysis Hints

- **After you are satisfied with all your charts, go back over them and finalize your analysis with markers.**

- ***APPLICATION: Students will practice what they have learned by analyzing charts. Since this is the first time many students are analyzing constant pressure charts, the instructor must stress proper techniques. Special emphasis should be placed on the correct use of wind data when contouring upper levels.***
- ***EVALUATION: Adminster the progress check. The upper level chart for the progress check is either the 700 mb or 500 mb chart from 00Z 14 MAR 93.***